A REPORT ON SWEETPOTATO WEEVIL INVESTIGATIONS 1/

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This report from the results of the investigations on the sweetpotato weevil, Cylas formicarius (F.), summarizes the remarks made by the writer at the group conference on the sweetpotato weevil problem held at Gulfport, Miss., on March 16, 1940, in which State and Federal workers participated. This report has been prepared primarily for the information of those engaged in suppressive measures against the sweetpotato weevil. The work was conducted at Sunset and Baton Rouge, La., in close cooperation with the Louisiana Agricultural Experiment Station and the Louisiana Department of Agriculture and Immigration, and covers briefly the investigations conducted from the fall of 1937 to the spring of 1940.

Biology

The sweetpotato weevil is an old pest of sweetpotatoes, and considerable information on its general life history and development was available before this work was started. The information given herein is confined principally to certain points on biology which have a direct bearing on control or eradication projects. At Baton Rouge a complete and thorough life-history study 1/ has been made under outside conditions, and the data obtained on rate of development have been fairly uniform. Probably the most noteworthy contribution to biological information has been the data obtained on the ability of the insect to survive in any stage of its life during the cooler periods of the year. These low temperatures retard the development of the various stages, but they will eventually survive and produce normal individuals. For example, the incubation period for eggs hatching during the month of January has ranged from 37 to 69 days, the larval period for specimens pupating during this month from 85 to 119 days, and the pupal period for all specimens observed from 33 to 40 days. From this information it may be seen that only one generation of weevils develops during the winter. By comparison, for all specimens observed during the month of August the incubation period ranged from 6 to 7 days, the larval period from 12 to 17 days, and the pupal period from 4 to 9 days. Experiments with breeding cages kept in a large, unheated, dry kiln also showed that only one generation develops in storage during the winter.

Overwintering in Sweetpotato Fields

The old sweetpotato field has been found to be an important link in weevil carry-over from year to year. In the vicinity of Sunset and Baton Rouge live specimens have been taken in the fields throughout the winter. For two winters emergence has occurred from sweetpotatoes left in the field and exposed to temperatures around 25° F. Adults have been found to emerge from vines and crowns left in fields after harvest; heaviest emergence continues for about 90 days, the peak occurring the first month after harvest. Emergence is much more rapid from potatoes and vines on the surface than from material covered with soil. The greater percentage of spring emergence occurs from material that has been covered

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1/ This work was under joint supervision with Dr. C. O. Eddy, entomologist at the Louisiana Experiment Station.

during the winter and brought to the surface with spring plowing. Adults that emerge in fields in winter will feed and lay eggs on crop remnants during the warm periods.

The severe cold wave in January 1940, when the temperature at Sunset reached a minimum of 11° F., and when snow and ice covered the ground for 10 days, apparently killed all adults in the fields that had emerged prior to the freeze, and the mortality of those in the sweetpotatoes remaining in the fields was much greater than that of the average for the two previous winters, which is about 20 to 25 percent. Mortality of specimens on the surface was more than 50 percent immediately after the freeze and increased until on March 1 it was approximately 80 to 82 percent; in unexposed potatoes the immediate mortality was around 50 percent, and it has continued to increase to April 21, 1940.

Longevity of Adults

During the winter of 1937-38 the longest period that an adult lived without food was 119 days. During the winter of 1938-39 four adults in different cages lived 126, 134, 135, and 144 days, respectively. Adults have lived as long as 50 days in the spring, 28 days in the summer, and 44 days in the fall. Examination of several cages in headlands showed winter survival in one cage to be 1 percent for 119 days; in another cage 1.4 percent for 113 days, 0.6 percent for 128 days, and 0.2 percent for 135 days; in a third cage 0.6 percent for 125 days, 0.4 percent for 130 days, and 0.2 percent for 144 days; and in still another cage 0.8 percent for 122 days and 0.2 percent for 126 days. In a cage in a sweetpotato field with metal roof for protection, 0.8 percent survived 105 days; and at Houma, La., in a cage filled with grass and debris 1 percent survived 134 days.

During the winter of 1938-39, 4 percent of adults survived the winter with sweetpotatoes for food, while survival in four cages during the winter of 1937-38 was 16, 28, 19, and 2 percent, respectively. Of 25,000 to 30,000 adults in insectary cages with sweetpotatoes in the fall of 1938, less than 1,000 were alive the following April.

In small field cages examined at 30-day intervals throughout the winter the survival at the end of 30 days has ranged from 35 to 78 percent, and after 60 days from 2 to 13 percent; after 90 days 1 percent of the adults were alive in one cage and all were dead in the other cages. These small cages were apparently not suitable for overwintering adults, for death was more rapid in them than in the large field cages. These tests show, however, the mortality trend of adults at these intervals throughout the winter.

Flight

Adults fly freely during the warm part of the year, but they rarely fly when the temperature is below 65° F. As many as 169 specimens were caught in one night in an electric-light trap placed about 40 feet from infested sweetpotatoes.

In 1938 trap sweetpotato patches became infested $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 mile from the point of weevil dispersal, and adults were caught in light traps $\frac{1}{4}$ and $\frac{1}{2}$ mile from the point of dispersal. Some marked adults were also released, and one was caught in a light trap $\frac{1}{2}$ mile away.

In 1939 trap patches became infested 940, 1,320, and 1,660 yards from the point of dispersal. In another experiment weevils that had been colored before liberation at focal points in flooded rice fields were caught in light traps $\frac{1}{2}$, $\frac{3}{4}$, 1, and $1\frac{1}{4}$ miles from the point of dispersal. Adults have also been caught on sticky screens from 4 to 7 feet above the ground near stored sweetpotatoes, old seed beds, and old sweetpotato fields.

Host Plants

More than 100 of the common wild plants growing in the vicinity of Sunset have been used in host-plant studies. During these observations adult weevils feed upon 25 wild and ornamental plantsand bred in 12. Breeding did not occur in any plants except those of the genus to which the sweetpotato belongs, Ipomoea, belonging to the morning-glory family. So far as known, breeding has not been reported heretofore in cypressvine (Ipomoea quamoclit L.), an ornamental, I. muricata Jacq., and a wild specimen, I. heptaphylla (Rotic. & Willd.) Voight.

During 1939, on a heavily infested sweetpotato farm from which infested sweetpotatoes were not removed in 1938, examination of samples of approximately 100 plants showed 54.5 percent of the volunteer sweetpotato plants, 71.5 percent of Ipomoea barbigera Sweet, 35 percent of I. hederacea Jacq., and 28 percent of I. pandurata (L.) Mey. to be infested. On another farm with a lighter infestation two lots of cypressvine showed 2 and 4 percent infestation, and on another place where approximately a 1-acre patch of cypressvine was found, it was estimated that 50 percent of the large, mature plants were infested.

Weevils are known to have carried over the winter in the seaside morning-glories, Ipomoea pres-caprae (L) Sweet and I. littoralis Blume, but in two winters' observations at Sunset we have not found any carry-over in the various morning-glories under observation. There appears to be no reason, however, why weevils will not carry over in the perennial root of Indian potato (I. pandurata), when the root is sufficiently exposed to weevil attack.

In laboratory and field-plot experiments weevils have showed little or no preference between sweetpotato plants and Ipomoea barbigera, I. hederacea, and I. trichocarpa Ell. Adults fed and bred freely upon the fleshy root of I. pandurata after having bred in sweetpotatoes, and vice versa.

Chemical Control

Although the adult sweetpotato weevil is easily killed with stomach poisons, experiments on field control where insecticides were applied to the growing crop for 2 years have not proved entirely satisfactory. When applications at 14-day intervals were made throughout the growing season, vines were afforded fairly satisfactory protection. Infestation was heavier in the sweetpotatoes than in

the vines, which were receiving the treatments, probably because adults attacked the sweetpotatoes directly through cracks in the soil. Insecticidal applications made early or late in the season were not so effective as applications made throughout the growing season. Eight or more applications, which are required for treatment throughout the season, are probably too many for growers to use economically.

Recent experiments show that poisoned bait, consisting of 20 parts of freshly grated sweetpotatoes and 1 part of paris green, applied by broadcasting around old storage sites, seed beds, and in fields after harvest, offers considerable promise, since many adults can be killed before they migrate to other fields or locations.

June 3, 1940.